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For official use

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9421653.8

Your reference

PBA/D087416PGB

### Notes

Please type, or write in dark ink using CAPITAL letters. A prescribed fee is payable for a request for grant of a patent. For details, please contact the Patent Office (telephone 071-438 4700).

Rule 16 of the Patents Rules 1990 is the main rule governing the completion and filing of this form.

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## Request for grant of a Patent Form 1/77

Patents Act 1977

### 1 Title of invention

- 1 Please give the title of the invention

WOUND DRESSING

### 2 Applicant's details

- ☐ First or only applicant

- 2a If you are applying as a corporate body please give:

Corporate name

INNOVATIVE TECHNOLOGIES LIMITED

Country (and State of incorporation, if appropriate)

UNITED KINGDOM

- 2b If you are applying as an individual or one of a partnership please give in full:

Surname

Forenames

- 2c In all cases, please give the following details:

Address

ROAD THREE  
WINSFORD INDUSTRIAL ESTATE  
WINSFORD  
CHESHIRE

UK postcode (if applicable)

CW7 3PD

Country

UNITED KINGDOM

ADP number (if known)

6128920001

**2d, 2e and 2f:** If there are further applicants please provide details on a separate sheet of paper.

☐ **Second applicant (if any)**

**2d** If you are applying as a corporate body please give:

Corporate name

Country (and State  
of incorporation, if  
appropriate)

**2e** If you are applying as an individual or one of a partnership please give in full:

Surname

Forenames

**2f** In all cases, please give the following details:

Address

UK postcode  
(if applicable)

Country

ADP number  
(if known)

**Ⓢ** An address for service in the United Kingdom must be supplied

Please mark correct box

**Ⓢ Address for service details**

**3a** Have you appointed an agent to deal with your application?

Yes ☒ No ☐ → go to 3b

↓  
please give details below

Agent's name

MARKS & CLERK

Agent's address

SUITE 301, SUNLIGHT HOUSE  
QUAY STREET  
MANCHESTER

Postcode

M3 3JY

Agent's ADP  
number

18004

**3b:** If you have appointed an agent, all correspondence concerning your application will be sent to the agent's United Kingdom address.

**3b** If you have not appointed an agent please give a name and address in the United Kingdom to which all correspondence will be sent:

Name

Address

Postcode

Daytime telephone  
number (if available)

ADP number  
(if known)

**PBA/D087416PGB**

**Please mark correct box**

5 Are you claiming that this application be treated as having been filed on the date of filing of an earlier application?

Yes ☐ No ☒ **⇒ go to 6**

↓  
***please give details below***

- number of earlier application or patent number**

-  **filing date**

day month year

- ☐ and the Section of the Patents Act 1977 under which you are claiming:

**Please mark correct box**

15(4) (Divisional) ☐ 8(3) ☐ 12(6) ☐ 37(4) ☐

**6 If you are declaring priority from previous application(s), please give:**

**6** If you are declaring priority from a PCT Application please enter 'PCT' as the country and enter the country code (for example, GB) as part of the application number.

**Please give the date in all number format, for example, 31/05/90 for 31 May 1990.**

Country of filing	Priority application number (if known)	Filing date (day, month, year)

- ⑦ The answer must be 'No' if:
- any applicant is not an inventor
  - there is an inventor who is not an applicant, or
  - any applicant is a corporate body.

⑧ Please supply duplicates of claim(s), abstract, description and drawing(s).

Please mark correct box(es)

- ⑨ You or your appointed agent (see Rule 90 of the Patents Rules 1990) must sign this request.

Please sign here ➡

A completed fee sheet should preferably accompany the fee.

## ⑦ Inventorship

7 Are you (the applicant or applicants) the sole inventor or the joint inventors?

Please mark correct box

Yes ☐

No ☒

A Statement of Inventorship on Patents Form 7/77 will need to be filed (see Rule 15).

## ⑧ Checklist

8a Please fill in the number of sheets for each of the following types of document contained in this application.

Continuation sheets for this Patents Form 1/77

—

Claim(s)

3

Description

7

Abstract

—

Drawing(s)

—

8b Which of the following documents also accompanies the application?

Priority documents (please state how many)

—

Translation(s) of Priority documents (please state how many)

—

Patents Form 7/77 – Statement of Inventorship and Right to Grant (please state how many)

—

Patents Form 9/77 – Preliminary Examination/Search

—

Patents Form 10/77 – Request for Substantive Examination

—

## ⑨ Request

I/We request the grant of a patent on the basis of this application.

Signed

MARKS & CLERK

Date 26/10/1994  
(day month year)

Please return the completed form, attachments and duplicates where requested, together with the prescribed fee to either:

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WOUND DRESSING

The present invention relates to wound dressings.

For the treatment of many types of wounds, particularly medium to highly exuding wounds (e.g. 2nd and 3rd degree burns, decubitus ulcers and leg ulcers) it is necessary to ensure that bulk exudate is removed from the wound and peripheral skin to reduce or eliminate maceration. Prior art dressings have not always proved satisfactory in venting the large amount of exudate present in a wound. As such, the dressing becomes saturated and this results in maceration and excoriation. Additionally, the dressing may require to be changed relatively frequently and this is a labour intensive operation.

According to the present invention there is provided a wound dressing provided in combination

- (i) a first wound contact layer which preferably has a positive effect on the healing of the wound, and
- (ii) a second layer of greater hydrophilicity than the first layer.

Layer (i) is designed to provide a positive action in assisting healing of the wound and may take various forms (as described later) depending on the type of wound to be treated. The provision of layer (ii) (which is of greater hydrophilicity than layer (i) ensures that exudate present in layer (i) may pass into layer (ii) so as to increase the time before layer (i) becomes saturated. Preferably the hydrophilicity of layer (ii) is at least twice, and more preferably 3 to 5 times, that of layer (i).

Layer (i) (i.e. the wound contact layer) will generally be relatively thin (e.g. 50-1000 microns) and may be such as interact

positively with the wound to assist healing thereof. Thus, for example, layer (i) may be one which provides for clotting via agglutination of red cells. Alternatively, the layer may be one which is capable of debriding the wound. A further possibility is for the layer to be one which delivers a component to the wound, e.g. an ion, drug, or anti-microbial agent. Examples of the materials which may be used for layer (i) are as follows:

(a) calcium alginate which will provide calcium ions for haemostasis;

(b) zinc alginate to deliver zinc ions into the wound to assist healing;

(c) silver alginate to deliver silver ions as powerful anti-microbial agents to infected wounds;

(d) chitosan to provide haemoglutination (i.e. clotting by gelation of red cells leaving the intrinsic and extrinsic clotting cascade intact). Chitosan also appears to have some beneficial effects on contact allergies and anti-microbial activity by stimulating the oxidative attack of white cells. Chitosan has also been reported to assist healing and reduce scarring;

(e) pectin for stimulating autolysis and wound debridement. The pectin may be provided, for example, as pectin/carboxymethyl cellulose/alginate or pectin/alginate;

(f) silver N,O-carboxymethyl chitosan or silver O-carboxymethyl chitosan;

(g) a gauze material prepared as described in our earlier U.K. Patent Application No. 9415828 and incorporating silver ions for delivery to the wound;

(h) a dehydrated hydrogel, e.g. of alginate or chitosan, which

is of high integrity when it picks up water.

Layer (i) may be provided as a woven, non-woven or knitted material or as a gel. The layer may be in the form of a "rope" for deep cavities or an amorphous gel for sinuses.

Various species may be incorporated in layer (i) for delivery to the wound, e.g.

- simple anti microbial agents (e.g.  $\text{Zn}^{2+}$  and  $\text{Ag}^+$ ) and metal ions which are enzyme cofactors

- enzymes such as collagenase and metallo proteases such as plasmin or plasminogen which can be dosed into layer (i) to be released into the wound during healing to aid fibrinolysis and reduce scar formation

- drugs, such as anti-inflammatories etc., for dermatological application.

Layer (i) will also capture proteins and growth factors from the wound, initially by adsorption and as this layer hydrates later in the healing process these proteins and growth factors will be delivered back to the healing wound.

Layer (ii) is preferably also of a woven, non-woven or knitted fibrous material, e.g. a felt.

Layer (ii) will generally have a thickness of 1000 to 5000 microns, preferably 1000 to 2500 microns and may comprise

- (a) sodium alginate/calcium alginate felt (e.g. containing 20-60% sodium);
- (b) a sodium calcium carboxymethyl cellulose felt;
- (c) a sodium zinc carboxymethyl cellulose felt;
- (d) a sodium calcium polyacrylate felt; or
- (e) a sodium calcium carrageenin felt.



- (f) an alginate/CMC felt.
- (g) carboxymethyl cellulose (CMC) felt; or
- (h) N,O-carboxymethyl chitosan (NOCC) felt.

The sodium in the above materials may be replaced by potassium.

One particular example of wound dressing in accordance with the invention comprises chitosan as layer (i) and an alginate or alginate/CMC felt as layer (ii).

As explained above, layer (ii) is of greater hydrophilicity than layer (i). The requisite hydrophilicity (rate of exudate absorption) for layer (ii) may be obtained by mixing fibres of varying sodium/calcium ratios (for felts (a), (b), (d), and (e)) and by mixing fibres of varying sodium/zinc ratios (for felt (e)). The absolute capacity of the felt for absorbing exudate may be varied by mixing fibres of varying hydrophilicity. For example the absorption capacity of felts made from CMC, polyacrylate or NOCC, all of which are powerfully hydrophilic, may be lowered by the incorporation of alginate fibres. Alternatively, materials of the requisite absorption capability may comprise alginates co-spun with other polymeric materials as disclosed in our copending U.K. Patent Application No. 9419572.

As an alternative to layers (i) and (ii) both being non-woven, it is possible for layers (i) and/or (ii) to be of other types of material (provided that layer (ii) is more hydrophilic than layer (i)). Examples of such alternative constructions are as follows.

(1) Layer (i) is a non-woven felt and layer (ii) is a hydrogel. An example of such a dressing is one comprising a non-woven felt of chitosan (as layer (i) with a NOCC hydrated hydrogel (as layer (ii)). In such a dressing, the chitosan provides haemostatic and anti-

microbial properties and the highly absorbing NOCC provides the exudate handling properties. The exclusive nature of the gel ensures that growth factors and other proteins from the wound remain in layer (i) (i.e. the chitosan layer) for ultimate delivery back to the wound. The dressing is suitable for donor sites and 2nd and 3rd degree burns. Obviously a NOCC hydrated hydrogel may be used in conjunction with other (less hydrophilic) materials as layer (i).

(2) Layer (i) may be comprised of spun hydrocolloid including a mixture of components to produce a product which is a cross between an alginate and a hydrocolloid. Thus, for example, it is possible to spin hydrocolloids from solutions of alginate, gelatin, pectin, and CMC, e.g. in the following amounts.

Alginate	Gelatin	Pectin	CMC
45	10	25	20
35	10	35	20

In this case, the layer (ii) may for example be a material as described in our aforementioned copending U.K. Patent Application No. 9415828, a relatively high sodium or potassium (e.g. 20-60%) calcium alginate, carboxymethyl cellulose or polyacrylic acid/alginate.

Layers (i) and (ii) may be joined together, e.g. by needling, punching, or may be applied separately to the wound.

In a highly preferred embodiment of the invention, the dressing film comprising layers (i) and (ii) is associated with a breathable water vapour permeable film which is of increased MVTR capability in the presence of liquid water as compared to moisture vapour only. MVTR in the presence of liquid water may be measured by ASTM E96BW whereas MVTR in the presence of moisture vapour only is measured by ASTM E96.

of moisture vapour alone may be measured by ASTM E96B (water method). Preferably the value of the breathability in the presence of liquid water is at least twice and preferably at least three times that in the presence of moisture vapour alone. The value may be up to 30 or 40 times that for moisture vapour alone. Typically the film will be of a material which has an MVTR in the presence of moisture vapour alone (ASTM E96B) of 2,000 to 2,500  $\text{g m}^{-2} \text{ 24hr}^{-1}$  and an MVTR in the presence of liquid water (ASTM E96BW) in the range 6,000 to 30,000  $\text{g m}^{-2} \text{ 24hr}^{-1}$  (e.g. 6,000 to 10,000  $\text{g m}^{-2} \text{ 24hr}^{-1}$ ). Typically the film will have a thickness of 30-70 microns more preferably 40-60 microns, e.g. about 50 microns.

The film may for example be of polyurethane. Suitable films are available from Innovative Technologies Limited under the designations IT325, IT425 and IT625.

An adhesive will be provided on the film for bonding the latter to the skin around the wound. The adhesive is preferably a hydroactive adhesive most preferably one which, as a continuous layer having a thickness of 20 microns, has an MVTR of 15,000  $\text{g m}^{-2} \text{ 24hr}^{-1}$  using ASTM E96B. Preferably the combination of the adhesive and film is such as to provide an MVTR of 6,000 to 10,000  $\text{g m}^{-2} \text{ 24hr}^{-1}$ . An example of a suitable adhesive is a hydroactive adhesive available from Innovative Technologies under the designation ITHA.

The hydroactive adhesive may be provided as a continuous layer on the film. The coating thickness is preferably in the range 15 to 25 microns e.g. about 20 microns.

Alternatively the adhesive may be a pressure sensitive adhesive provided as a cross-pattern to achieve 20-50% area coverage and to achieve similar MVTRs for the combination of adhesive and film of

6,000 to 10,000 g m<sup>-2</sup> 24hr<sup>-1</sup>.

When the dressing is applied to a wound, the film will generally simply be laid over the combination of layers (i) and (ii).

In use of the dressing comprising such a film, exudate from the wound will initially be absorbed into layer (ii) and will pass therethrough until it comes into contact with the film. The breathability of the film is increased in contact with the liquid present in layer (ii), the increase being dependant on the amount of exudate present in layer (ii) (a greater amount of exudate in layer (ii) producing a greater increase in the breathability of the film). Moisture is therefore able to vent from layer (ii) via the film at a rate which is greater than the MVTR of layer (ii) which is therefore prevented from becoming saturated.

As the wound begins to dry-up during the healing process, the MVTR of the film decreases so that layer (ii) remains moist and does not dry out, thus facilitating healing.

CLAIMS

1. A wound dressing provided in combination:
  - (i) a first wound contact layer which preferably has a positive effect on the healing of the wound, and
  - (ii) a second layer of greater hydrophilicity than the first layer.
2. A dressing as claimed in claim 1 wherein the hydrophilicity of layer (ii) is at least twice that of layer (i).
3. A dressing as claimed in claim 2 wherein the hydrophilicity of layer (ii) is 3 to 5 times that of layer (i).
4. A dressing as claimed in any one of claims 1 to 3 wherein layer (i) has a thickness of 50 to 1,000 microns.
5. A dressing as claimed in any one of claims 1 to 4 wherein layer (i) is one which provides for clotting via agglutination of red cells.
6. A dressing as claimed in any one of claims 1 to 4 wherein the layer (i) is one which is capable of debriding the wound.
7. A dressing as claimed in any one of claims 1 to 4 wherein layer (i) delivers a component to the wound.
8. A dressing as claimed in any one of claims 1 to 4 wherein layer (i) comprises calcium alginate, zinc alginate, silver alginate, chitosan,

pectin, silver N,O-carboxymethyl chitosan, silver O-carboxymethyl chitosan or a dehydrated hydrogel.

9. A dressing as claimed in any one of claims 1 to 8 wherein layer (ii) is a woven, non-woven or knitted fibrous material.
10. A dressing as claimed in any one of claims 1 to 9 wherein layer (ii) has a thickness of 1,000 to 5,000 microns.
11. A dressing as claimed in any one of claims 1 to 10 wherein layer (ii) is a felt comprised of sodium alginate/calcium alginate, sodium calcium carboxymethyl cellulose, sodium zinc carboxymethyl cellulose, sodium calcium polyacrylate or sodium calcium carrageenin.
12. A dressing as claimed in any one of claims 1 to 11 which is associated with a breathable film having an increased MVTR capability in the presence of liquid water as compared to moisture vapour alone.
13. A dressing as claimed in claim 12 wherein the film has an MVTR in the presence of moisture vapour alone of  $2,000$  to  $2,500 \text{ g m}^{-2} 24\text{hr}^{-1}$ .
14. A dressing as claimed in claim 12 or 13 wherein the film has an MVTR in the presence of liquid water of  $6,000$  to  $30,000 \text{ g m}^{-2} 24\text{hr}^{-1}$ .
15. A dressing as claimed in any one of claims 11 to 15 wherein the film has a thickness of 30-70 microns.
16. A dressing as claimed in anyone of claims 12 to 15 wherein the

film is of a polyurethane.

17. A dressing as claimed in any one of claims 12 to 16 wherein an adhesive is provided on the film for bonding the latter to skin around the wound.

18. A dressing as claimed in claim 17 wherein the adhesive is a hydroactive adhesive.

19. A dressing as claimed in claim 18 wherein the adhesive is one which, as a continuous layer having a thickness of 20 microns, has an MVTR of  $15,000 \text{ g m}^{-2} \text{ 24hr}^{-1}$ .

20. A dressing as claimed in any one of claims 17 to 19 where the adhesive is provided as a continuous layer.

21. A dressing as claimed in any one of claims 17 to 20 wherein the thickness of the adhesive is 15 to 25 microns.

22. The combination of a wound dressing as claimed in any one of claims 1 to 11 and a breathable film having an increased MVTR capability in the presence of liquid water as compared to moisture vapour alone.

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